Remarks

Applicants' attorney would like to thank Examiner Zervigon for the courtesy of a telephone interview conducted on February 15, 2006 to discuss the pending claims and the references cited in the Office Action mailed on November 29, 2005. In the Office Action:

- Claims 1, 4, 5, 8, and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Soichiro Kawakami (JP 61037969) in view of Ohashi (JP 10177960);
- Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over Soichiro and Ohashi in view of Ishii (US 5,685,942);
- Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Soichiro and Ohashi in view of Lemp (US 4,836,246); and
- Claims 9 and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Soichiro and Ohashi in view of DeDontney (US 5,849,088).

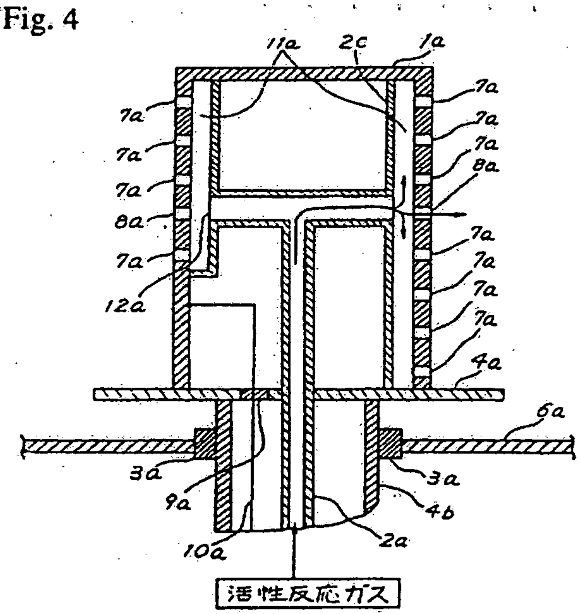
During the telephone interview, Applicants' attorney pointed out that there were no motivation and no likelihood of success in replacing Soichiro's cathode support plate 4 in FIG. 1 with the top portion of Ohashi's chemical vapor deposition chamber shown in FIG. 4 or FIG. 6. The Examiner disagreed, asserting that the motivation was to avoid deposition or particle accumulation on the partitions. No agreement was reached during the telephone interview.

With this Amendment, Claims 1 and 11 have been amended for clarity without introducing new issues of patentability.

Applicants maintain the position that there are no motivation and no likelihood of success in combining Soichiro with Ohashi, and no suggestion in either reference for such as combination. The object of Soichiro is to overcome the shortcomings of the conventional plasma CVD apparatus shown in FIG. 4 in Soichiro, which is reproduced below. The conventional plasma CVD apparatus has coaxial electrodes including a cathode 1a and a counter electrode (not shown) facing the cathode 1a and serving as a support for a substrate on which a thin film is formed by deposition. The peripheral wall of the cathode is provided with a plurality of gas-spraying openings 7a disposed at regular intervals in the peripheral and axial directions.

A cylindrical partition 2c is disposed inside the cathode 1a, whereby an annular space is formed between the cathode 1a and partition 2c as a conduit 11a for a reaction gas. A pipe 2a for supplying the reaction gas extends into the partition 2c and one end thereof opens into a tube 2b inside the partition 2c. The tube 2b is horizontal, and both ends thereof are fixed to the partition 2c such that they open into the conduit 11a. (See page 4 of translation.)

Fig. 4

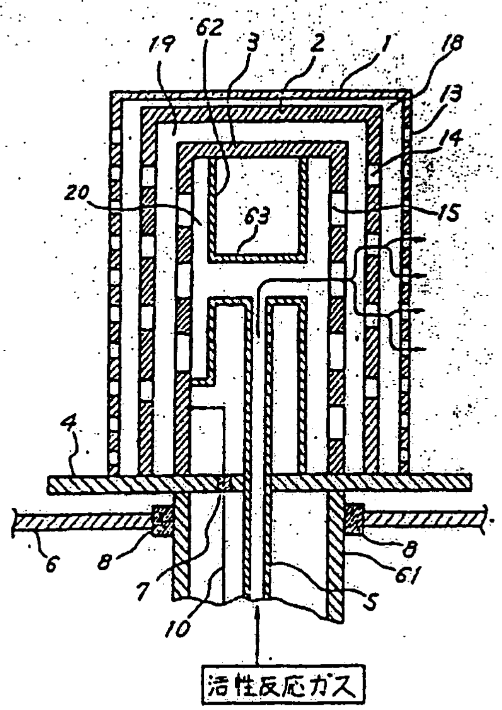


As stated in Soichiro, the conventional apparatus has the drawback that the openings 7a (particularly those labeled "8a") formed in the peripheral wall of the cathode 1a are disposed in a facing arrangement with the openings in the two ends of the tube 2b, as shown in FIG. 4. Consequently, more of the active reaction gas is fed through the openings 8a than through the openings 7a, and the active reaction gas cannot be fed uniformly to the substrate disposed in a facing arrangement with the cathode 1a. (See first two paragraph on page 5 of translation.)

To overcome the above shortcomings of the conventional apparatus, Soichiro provides an apparatus that allows an active reaction gas to be fed uniformly to a substrate supported on the counter electrode. The apparatus, shown in FIG. 1 in Soichiro, which is reproduced below, includes a cathode 1 having a cylindrical portion fixed to a cathode support plate 4. The space within the cathode 1 is provided with three partitions 2, 3, and 62, disposed coaxially with the cathode 1 and fixed to the cathode support plate 4. The partitions form buffers 18, 19, and 20 for the active reaction gas. The peripheral walls of cathode 1, partition 2, and partition 3 are

provided with openings 13, 14, and 15, respectively, which are disposed at regular intervals in the peripheral and axial direction. The openings 13, 14, and 15 are formed such that their axes do not coincide with each other. So, the gas admitted through the openings from a preceding buffer always impinges on the external peripheral wall surfaces of the subsequent buffer, creating a diffusion effect to spread the gas in the subsequent buffer.

Fig. 1



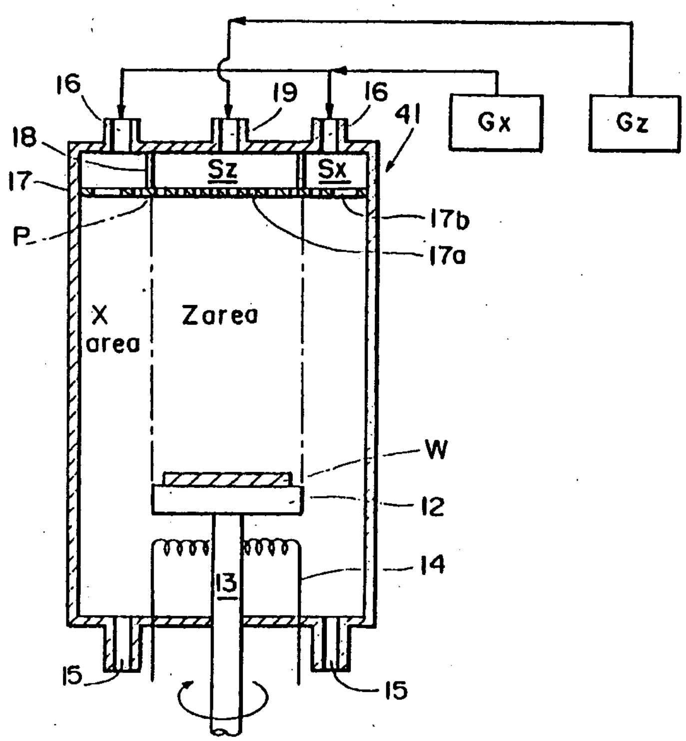
On the other hand, Ohashi aims to solve the problems of crystal defect and the adhesion of particles on a wafer substrate on which a thin film is formed in a conventional reactor (Paragraph [0004]). In the conventional reactor 71 (shown in FIG. 7 in Ohashi), reaction gas such as silicon raw-material gas is introduced from the top portion of the reactor and supplied onto a wafer substrate W sitting on a rotating substrate holder 72 at a uniform flow rate. The reaction gas thus reaches the vicinity of the wafer substrate W at the lower portion of the reactor 71, which is heated to a high temperature from the upper portion thereof by a heater 74. As a result, an upward-moving stream of the reaction gas occurs to induce a blow-up phenomenon to the reaction gas along the wall of the reactor, so that an eddy flow of gas occurs. Since the heated reaction gas flows upwardly, the temperature of the overall area in the reactor 71 is also

increased to promote uniform nucleus formation of thin-film forming raw-material gas in vapor phase, so that occurrence of particles is increased in vapor phase. Aside from the gas eddy flow, there is also the so-called "disturbance of gas," which is caused by the complicated gas flow at the outer periphery side of the rotational substrate holder 72. The "disturbance of gas" promotes reaction of non-reacted gas so that thin film components are deposited on the outer periphery surface of the rotational substrate holder 72. (See Paragraph [0005] of Ohashi.)

To solve the problems of the gas eddy flow and the "disturbance of gas," Ohashi discloses a reactor 41 (shown in FIG. 4) and a reactor 61 (shown in FIG. 6). In the reactor 41, a partition plate 18 divides the upper portion of the reactor 41 into a peripheral space area Sx and a center space area Sz (Col. 10, lines 46-50). The space area Sx and the space area Sz are separately provided with gas supply ports 16 and a gas supply ports 19, respectively. Further, the gas supply ports 16 and the gas supply port 19 are separately connected to different gas supply system Gx and Gz, respectively (Col. 11, lines 8-12). The reaction gas containing the thin-film forming raw-material gas and the carrier gas are supplied into the space areas Sx and Sz partitioned by the partition plate 18 at different gas flow rates respectively by the gas supply system Gx and Gz (Col. 11, lines 20-27). Further, only the carrier gas may be passed through the X area (Col. 11, lines 27-28). Similar description of the reactor 61 can be found in Paragraphs 28-29 in Ohashi.

The Examiner reject Claim 1 in the Office Action with the rational that the cathode support plate 4 in Soichiro may be replaced by the upper portion of the reactor 41 in Ohashi. This rejection is respectably traversed. Applicants see no motivation or suggestion in either of the references for such a combination. Reaction gases do not usually form particles before they are introduced into the reaction chamber, where heat or plasma enhancement cause reactions to happen. Otherwise, the gas tubes, such as the tube 5, for supplying the reactions gases would be easily congested and have to be constantly flushed to get rid of the particles. The problems of the gas eddy flow and the "disturbance of gas" in Ohashi, which happens in the reaction chamber 71, simply do not occur within the cathode 1 in Soichiro because Soichiro employs neither a heater nor a rotating element in the cathode 1 to cause such problems. What Soichiro really attempts to do is to carefully design the gas flow paths through the layered openings 13, 14, and 15 in the partitions 2 and 3 and the cathode1 so that reaction gas may be introduced uniformly

into the reaction chamber through the cathode 1. It is unreasonable to assume that Soichiro would take the approach of Ohashi by blowing the non-reacted reaction gas away through some exhaust before the gas ever gets out of the cathode 1, in order to avoid particle formation in the cathode 1.



Furthermore, there is no reasonable likelihood of success for such a combination. Based on the configuration of Soichiro, if there were problems with particle formation within the cathode 1 because of the introduction of the reaction gas into the buffers 18, 19, and 20 through tube 63 and the openings 14 and 15 in the partitions 2 and 3, there is no reason to assume that introducing the same reaction gas through the cathode support plate 4 would make any difference in particle formation. Moreover, introducing gas into the spaces between the cathode 1 and partition 2, the partitions 2 and 3, and/or the partitions 3 and 62 from the bottom of the partitions would disturb the gas flow paths carefully designed in Soichiro, destroy the gas distribution uniformity Soichiro attempts to achieve, and defeat the purpose of the invention in Soichiro. As shown in FIG. 1 in Soichiro, which is reproduced above, if the reaction gas is introduced into the buffers 18, 19, and 20 through the cathode support plate 4, more reaction gas will get through the openings 13, 14, and 15 near the cathode support plate 4. If a carrier gas is introduced through

the cathode support plate 4 into the buffers 18, 19, and 20, the carrier gas will blow the reaction gas coming into the buffers through the tube 63 and openings 14 and 15 toward the top of the buffers 18, 19, and 20 so that more reaction gases will exit the openings 13, 14 and 15 near the top of the buffers. Either way, the gas flow uniformity in Soichiro will be greatly disturbed if not completely destroyed.

In addition to the lack of motivation and likelihood of success, the combination suggested by the Examiner also does not teach the invention in Claim 1, which calls for a gas delivery metering tube comprising, among other things, an inner tube, an outer tube, and a gas flow divider positioned adjacent the inlet ends of the inner and outer tubes and having a first gas flow path coupled to said inner tube and a second gas flow path coupled to the annular space between the inner and outer tubes, the gas flow divider configured to divide gas from a single gas supply port coupled to one end of the gas delivery metering tube into a first gas flow path into an inner tube and a second gas flow path into the annular space between the inner tube and an outer tube.

First of all, contrary to the assertion of the Examiner, the top portion of the reactor 41 in Ohashi is not a gas flow divider. A gas flow divider, as commonly known and as recited in Claim 1, should divide a gas flow from a single gas supply port into a plurality of gas flow paths into separate areas. Although the top potion of the reactor 41 in Ohashi is divided by the plate 18 into different areas Sx and Sz, these different areas Sx and Sz are not connected to a single gas supply port. On the contrary, they are separately provided with the gas supply ports 16 and the gas supply ports 19, respectively (Col. 11, lines 8-12). The gases are also supplied into the space areas Sx and Sz at different gas flow rates respectively by the gas supply system Gx and Gz, and only the carrier gas may be passed through the X area (Col. 11, lines 20-28). Thus, the gas flows into the areas Sx and Sz in Ohashi cannot even be changed to be from a single gas supply port. Therefore, the combination of Soichiro and Ohashi cannot be used to reject Claim 1, and Claim 1 is patentable over Soichiro and Ohashi.

The above arguments apply to Claim 11 also. Therefore, Claim 11 is also patentable over Soichiro and Ohashi.

Claims 4-10 depend from Claim 1 and are patentable for the same reason as Claim 1 and by reason of the additional limitations set forth therein.

In view of the foregoing, it is respectfully submitted that this application is now in condition for allowance. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. The Commissioner is hereby authorized to charge any other fees determined to be due to Deposit Account 50-2319 (Order No. A-67178-1/MSS/TJH(463035-420)).

Respectfully submitted,

Jamie J. Zheng
Reg. No. 51,167

Customer No. 32,~~090~~ 940
DORSEY & WHITNEY LLP
Suite 1000, 555 California Street
San Francisco, CA 94104-1513
Telephone: (650) ~~494-8700~~ 857-1717